MONTHLY
PROGRESS REPORT

AEA Grant Agreement # 7310058

Project Title:
BRI Cyclo-Turbine™ Energy Production

Grantee:
Boschma Research, Inc.
138 Lawler Drive
Brownsboro, Alabama 35741

Reporting Period:
AUGUST 2013

Overview

Boschma Research, Inc. (BRI), AEA Grant Agreement #7310058 was signed on 1 April 2013, and the fully executed agreement arrived at BRI on 4 April. An Advance Payment of $120,481 was received by BRI on 16 April. A 2nd Advance Payment of $118,453 was received by BRI on 24 June. A 3rd Advance Payment of $104,368 was received by BRI on 30 August.

Deliverables Submitted:
None this month

Budget: ***Amount invoiced, briefly describe expenditures.***

August Invoice Amount:	$61,252
August Grant Amount:	$49,221
August Matching Amount:	$12,031
1st Advance Payment Balance:	$ 0
2nd Advance Payment Balance:	$ 0
3rd Advance Payment Balance:	$59,277

Expenditures include the cost of labor, materials and supplies, Engineering Support and other costs directly associated with fabricating and testing the Cyclo-Turbine system for Igiugig.

August Matching Amount is the labor of Jim Boschma and Judy Boschma and $355.85 in shipping costs.

Schedule Status: ***Based on the schedule outlined in the grant agreement, indicate if you are on schedule and capable of completing all tasks identified in Budget/Milestones table.***

BRI continues to work on Tasks 2 and 4

BRI has completed Tasks 1 and 3

Percent Complete: ***List in a table the primary tasks contained in the Budget/Milestones table and report the cumulative percent complete for each task listed.***

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Boschma Research, Inc.

Project Title: **BRI Cyclo-TurbineTM Energy Production**
Contact Person: **James H. Boschma, BRI CEO**

Realignment Completion %
31-Aug-2013

Mile-stones		Task	Start Date	End Date	Grant Funds	Match Funds	Total Budget	Deliverables	Com-plete
	1	Kickoff meeting	*Apr 2013*	*Apr 2013*	$ 2,782	$ 870	$ 3,652	Updated deployment schedule	100%
	2	Procure materials and supplies	*Apr 2013*	*June 2013*	104,970	10,820	115,790		82%
	3	Site visit: Igiugig	*May 2013*	*June 2013*	32,752	11,311	44,063	Electrical interconnection plan	100%
	4	Fabricate and test system	*Apr 2013*	*July 2013*	189,752	25,449	215,201	Performance test results, deployment/ retrieval plan	87%
MS 1: AEA accepts Tennessee River performance test results									
MS 2: Biological monitoring plan approved, required permits issued or pending									
MS 3: AEA accepts interconnection plan and deployment/retrieval plan									
	5	Ship systems to Igiugig	*Jul 2013*	*Jul 2013*	5,285	19,559	24,844		0%
	6	Set up and deployment - 2013 season	*Aug 2013*	*Oct 2013*	100,315	9,531	109,846		0%
	7	Biological Monitoring - 2013 season	*Aug 2013*	*Oct 2013*	140,000	-	140,000		10%
	8	Progress inspection	*Sep 2013*	*Sep 2013*	26,167	8,879	35,046		0%
	9	Retrieve device/store	*Oct 2013*	*Oct 2013*	28,143	8,879	37,022	2013 deployment report	0%
MS 4: AEA accepts 2013 deployment report									
	10	Set up and deployment - 2014 season	*May 2014*	*Aug 2014*	40,014	10,716	50,730		0%
	11	Progress inspection	*Aug 2014*	*Aug 2014*	31,195	12,181	43,376		0%
	12	Retrieve device	*Aug 2014*	*Aug 2014*	19,579	9,244	28,823		0%
	13	Draft project report	*Oct 2014*	*Oct 2014*	6,676	13,921	20,597	Draft project report	0%
	14	Final project report	*Nov 2014*	*Nov 2014*	1,000	-	1,000	Final report	0%
MS 5: AEA accepts final report									
Total					$ 728,630	$ 141,360	$ 869,990		

Work Progress: ***List each Primary Task in which work was performed & describe work completed***

Task 2. Procure materials and supplies

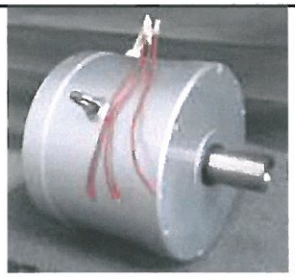
Task 4. Fabricate and test system

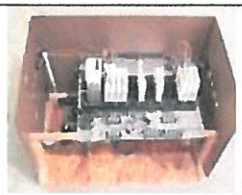
The BRI Cyclo-Turbine™ system engineering team has designed and constructed an electrical load that will simulate a 480 VAC 3-Phase power grid load. Six water heater elements installed in a surplus beer keg, along with appropriate switches comprise this electrical load. Transformers for the 3-Phase simulator have arrived, but we continue to await arrival of the phase converter.

The gearbox arrived at the end of August, after a seven week delay. Spline shafts and mounting dimensions were correlated to the gearbox CAD model as part of a final dry box review. Turbine-to-gearbox and gearbox-to-generator shaft coupling blanks have been machined. These will be sent out for keyway and spline broaching operations in early September.

A mockup of the dry box forward half (which houses the data acquisition and control electronics) was built to facilitate parallel electronic subsystem installation, wiring, and testing activities as dry box mechanical components are fabricated.

The Dry Box and System Testing: The Gearbox, 3-phase load, and dry box mockup images can be seen below, and at: http://www.weakforcepress.com/DevSys/130831/index.html

 **Gearbox with Splined Shafts Inserted** The turbine, which will be situated behind the gearbox, drives the gearbox through the SAE 1-3/8-6B shaft seen in the foreground. The gearbox drives the generator at 3.94 times turbine speed through the SAE C-4 flange and 1-3/8 21T 16/32 DP shaft in the background.	 **Gearbox with Splined Shafts in Foreground** The SAE 1-3/8-6B shaft (front) connects the gearbox and turbine; the 1-3/8-21T 16/32 DP shaft (rear) connects the gearbox and generator through a custom coupling.	 **Permanent Magnet Generator** A 5kW permanent magnet generator converts mechanical energy from the turbine into 3-phase variable-frequency AC current, which is then converted to 480 VAC 3-phase power suitable for the Igiugig grid by shore-based components.	 **Permanent Magnet Generator** The 60mm generator shaft is coupled to the gearbox via a custom coupling.	 **Three Phase Load** Constructed using six water heater elements installed in a surplus beer keg, the 3-phase load will absorb power generated during testing.

 **Dry Box Front-Half Mockup** The dry box top is closest to the viewer, who is looking into the outboard side; river flow is from left to right. Openings for watertight connectors are visible in the foreground. A connector in the top large hole receives power from shore for operating the data acquisition and control electronics. A connector in the bottom large hole provides communication between the Cyclo-Turbine and shore. The horizontal row of holes mount connectors for (left to right) ambient flow sensor, convergent flow sensor, turbine flow sensor, divergent flow sensor, and turbine blade angle control.	 **Dry Box Front-Half Mockup** This view shows the bottom of the dry box; flow is from right to left. The five holes in the bottom are fitted with watertight connectors for (right to left) fore mooring load, port mooring load, starboard mooring load, water temperature, and a spare.	 **Dry Box Front-Half Mockup** Data acquisition and control components are mounted on a plate, along with terminal blocks for connecting internal sensors. The multi-colored cables at each end are prototype flow sensor and load cell cables. Pressure control components are situated below the electronics mounting plate.	 **Dry Box Front-Half Mockup** Pressure control components detail.	 **Dry Box Front-Half Mockup** Data acquisition and control electronics detail.

Data acquisition and control software was enhanced to affect automatic active dry box pressure control using the pressure control components described in the July report.

The turbine blade pitch control actuator has arrived and accommodations made for its fitting to the blade pitch control mechanism.

Fabrication of the Venturi undercarriage structure was complete and the undercarriage was assembled.

The support structure for the pontoon floats was fabricated and preliminary assembly was completed. The pontoons will be installed shortly.

The debris guard preliminary structure was assembled and approximately 50% of the tine wire-attaching brackets were installed.

The in-water training site has been selected. The final testing site has not yet been resolved. However, discussions with the Redstone Arsenal Renewable Energy Project Manager yielded several potential sites that we will inspect in the coming weeks.

To see photos of electrical assemblies visit the web site as follows:
http://www.weakforcepress.com/DevSys/130531/index.html
http://www.weakforcepress.com/DevSys/130630/index.html
http://www.weakforcepress.com/DevSys/130731/index.html

- Described unexpected problems encountered and their impact

- Include/attach supporting documents such as test plans, results, diagrams, CAD drawings, or photos

Future Work: Report the following information on work anticipated for next reporting period:
- List each primary task in which work will be performed and describe work anticipated

Task 2. Procure Materials and Supplies
Task 4. Fabrication and Test System

Fabrication of the Venturi system, the undercarriage, and the turbine box/support structure are close to completion. The Debris Guard will require several additional man-days of labor stringing the high-strength tines on ½ inch centers. Final bracing of the Debris Guard will be via tensioned stainless steel cables to be adjusted once all tines are installed.

Site selection is underway for both a training site and a validation test site on/near the Tennessee River. An initial crew training site has been identified and coordination for its use has been successful. The Test and Demonstration Site has not yet been coordinated, but will be selected within a few weeks.

BRI will use the following site for training on system transport, system assembly, and deployment into and extraction from the water. This training will also include anchoring exercises and preparation for power generation.

BRI will transport, assemble and do water training with the Venturi and Debris Guard to establish handling procedures for the system and to complete the 'deployment/retrieval plan' portion of Milestone 3. (The Interconnection Plan was previously submitted for approval.)

After this initial training, BRI personnel will return the system to the BRI facility and install the Turbine and Generator. After shop testing is successfully completed, we will take the total system to a site on the Tennessee River for training and testing. When we are proficient with the handling of the system, we will coordinate with AEA members and schedule a time for them to come to Alabama to observe the performance tests and fulfill Milestone 1: AEA accepts Tennessee River performance test results.

- Describe anticipated problems that may be encountered, their impact, and proposed workarounds.

NOTHING FOLLOWS